Pollution Prevention: Region 5 Hazardous Substance Reduction On the Path to Greener Chemistry

Module 2: Design for the Environment Tools and External Resources for Identifying Safer Chemical Alternatives

EPA
United States
Environmental Protection
Agency

MODULE INTRODUCTION

The U.S. Environmental Protection Agency (EPA) has developed a160 slide, 4-part training module series (approximately 5 hours for the self-guided module series) that describes EPA's Design for the Environment Program and resources that can be used for identifying safer chemical alternatives (Module 2 of 4). This module is the result of collaboration among EPA headquarters and EPA Region 5; input from other EPA Regions is underway, and will be used to inform updated modules. This document provides key information on using this module.

This module can be used as a stand-alone training or in conjunction with EPA's other related training modules to provide a more in-depth training for P2 staff and P2 Technical Assistance Providers (TAPs) on hazardous substance reductions. The goal of this module, and the overall training series, is to inform P2 staff and P2 TAPs of proven approaches, strategies and tools that can be used to achieve increased hazardous substance reductions. To achieve this goal, EPA will increase the awareness of existing tools and approaches so they can successfully be integrated into organizational P2 assessment protocols. Each of the modules includes specific goals that will support the overall training goal and desired outcomes.

The material in this presentation should not be quoted or cited as official EPA policy. Additionally, the tools identified in this presentation are not an endorsement of, or intended to be an endorsement of any particular tool, unless it was developed by EPA.

INTENDED USERS AND TARGET AUDIENCE

This module is intended for use by P2 TAPs and State P2 staff who want to better understand EPA's Design for the Environment (DfE) assessment approach and resources that can be used to achieve greater hazardous substance reductions.

TRAINING MODULE OBJECTIVES:

- Increased understanding of the DfE assessment approach for developing safer chemical alternatives.
- Increased use of resources and tools to identify safer chemical alternatives, thereby reducing hazardous substance usage.

The module begins by describing EPA's Design for the Environment (DfE) tools and resources to identify safer chemical alternatives, such as the DfE Chemical Alternatives Assessment approach, Safer Product Labeling, and the Safer Chemical Ingredients List. The module then touches on external resources such as CleanGredients, SUBSPORT, and the Lowell Compendium that further supports hazardous substance reduction opportunities.

HOW TO USE THIS MODULE

This module is available as a PowerPoint presentation with slides. The recommended timeframe is approximately 1 hour for the presentation. EPA may update and adapt the training module to reflect region-specific and state-specific issues and concerns, as well as incorporate new policy and legal considerations as they arise.

ADDITIONAL RESOURCES

USEPA (U.S. Environmental Protection Agency). Design for Environment
http://www.epa.gov/dfe

MODULE AT A GLANCE

Duration & ***Elapsed Time***	**Module 2 Topics**	**Pages**
20 minutes *20 minutes*	Overview of DfE Tools and Resources	6-19
15 minutes *35 minutes*	DfE Chemical Alternative Assessments	20-28
25 Minutes *1 hour*	External Tools For Assessing Hazards and Finding Alternatives	29-43
TOTAL TIME: 1 HOUR		

Icon Key

Instructions
This icon means there are specific instructions for the facilitator. This content should not be read aloud.

Background Information
This icon indicates that there is background information the facilitator should be aware of when covering this topic. This information is for the facilitator only.

Say
This icon means the facilitator should read the content nearly verbatim, interjecting his/her thoughts when appropriate.

Key Point
This icon indicates an important point that the facilitator should communicate to the audience in his/her own words.

Discussion Questions
This icon means the facilitator should allow time for the audience to ask questions or the facilitator should ask the audience questions.

View Video
This icon indicates the facilitator will have students watch a video.

Online Resource
This icon indicates the facilitator will have students visit an online resource.

Handouts
This icon indicates the facilitator will give students a handout or other resource material.

Topic Transition
This icon indicates the facilitator will provide a transition from one topic to another.

Sub Topic

Overview of DfE Tools and Resources
20 minutes

Specific Outcomes

Increased use of resources to identify safer chemical alternatives, thereby reducing hazardous substance usage.

Notes for the Facilitator

Instructions: This is the first slide of a series that focus on topics related Design for the Environment (DfE) Tools and Resources.

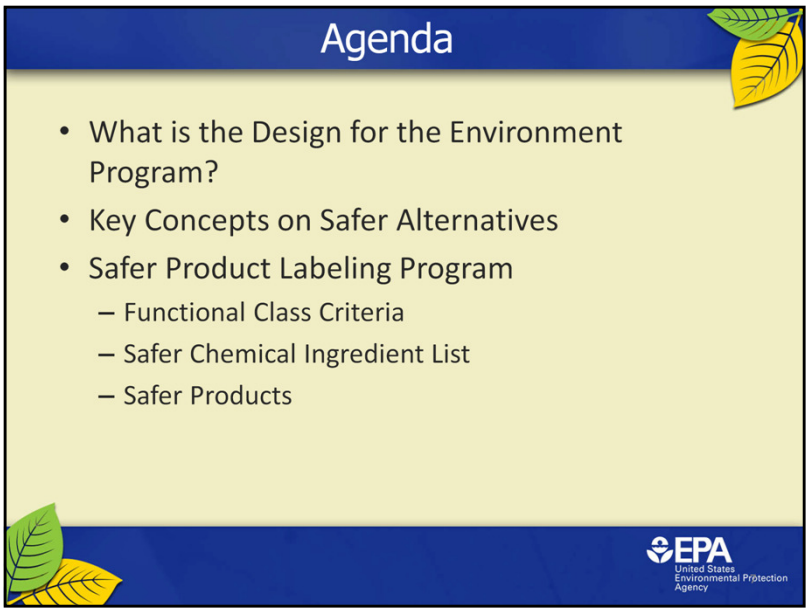
Discussion Questions: Ask the trainees about their familiarity with the DfE.

Sub Topics

- EPA's Design for the Environment (DfE) tools and resources
- Safer Product Labeling
- The Safer Chemical Ingredients List

Desired Outcomes

- Increased use of resources to identify safer chemical alternatives, thereby reducing hazardous substance usage.



Sub Topic

Overview of DfE Tools and Resources
20 minutes

Specific Outcomes

Increased use of resources to identify safer chemical alternatives, thereby reducing hazardous substance usage.

Notes for the Facilitator

Say: The topics that we will discuss in the first section of this module include:

- The Design for the Environment Program
- Key Concepts on Safer Alternatives
- Safer Product Labeling Program
    - Functional Class Criteria
    - Safer Chemical Ingredient List
    - Safer Products

Say: EPA's Design for the Environment (DfE) program helps consumers, businesses, and institutional buyers identify cleaning and other products that perform well, are cost-effective, and are safer for the environment.

P2: On the Path to Greener Chemistry

Sub Topic

Overview of DfE Tools and Resources
20 minutes

Specific Outcomes

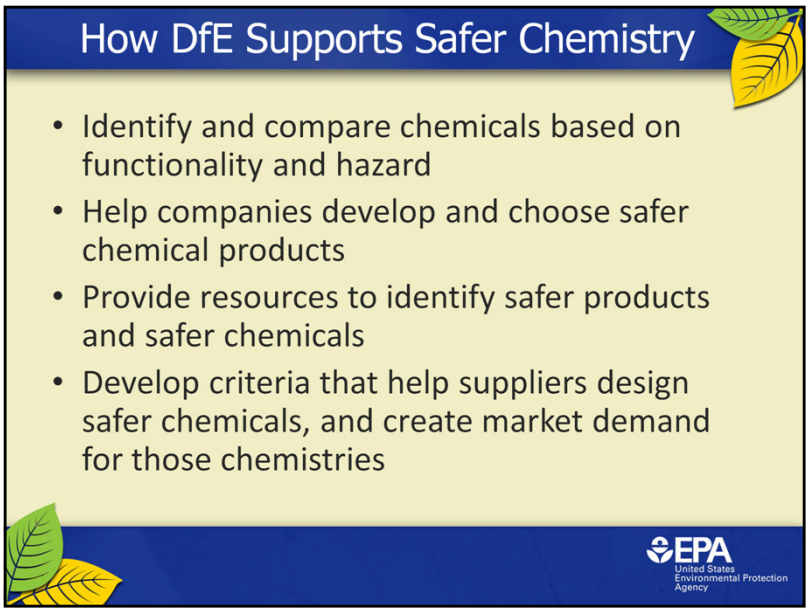
Increased use of resources to identify safer chemical alternatives, thereby reducing hazardous substance usage.

Notes for the Facilitator

Say: DfE works in partnership with industry, environmental groups, and academia to reduce risk to people and the environment by finding ways to prevent pollution. For more than 20 years, through partnership projects, DfE has evaluated human health and environmental concerns associated with traditional and alternative chemicals and processes in a range of industries. These analyses empower businesses to select safer chemicals and technologies.

Key Point: As incentives to businesses for participation and driving change, DfE offers EPA technical tools, methodologies, and expertise. This expertise in Green Chemistry, toxicology, and modeling enables industry to make more ***informed decisions***.

DfE allows products that have been determined to be effective and safer for human health and the environment to carry its label. Before you buy, look for the DfE label on household cleaners and other products.


How DfE Supports Safer Chemistry
• Identify and compare chemicals based on functionality and hazard
• Help companies develop and choose safer chemical products
• Provide resources to identify safer products and safer chemicals
• Develop criteria that help suppliers design safer chemicals, and create market demand for those chemistries
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Sub Topic

Overview of DfE Tools and Resources
20 minutes

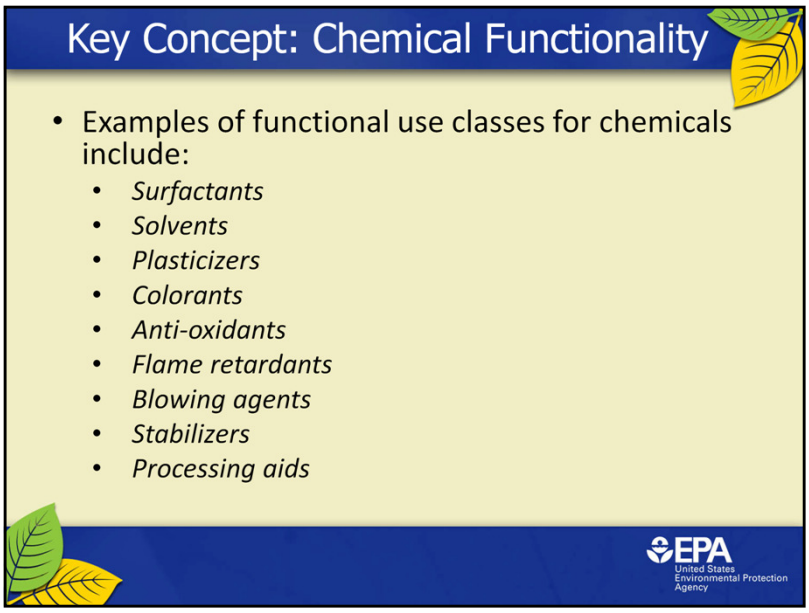
Specific Outcomes

Increased use of resources to identify safer chemical alternatives, thereby reducing hazardous substance usage.

Notes for the Facilitator

Say: DfE supports safer chemistry by:

- Identify and compare chemicals based on functionality and hazard
- Help companies develop and choose safer chemical products
- Provide resources to identify safer products and safer chemicals
- Develop criteria that help suppliers design safer chemicals, and create market demand for those chemistries



Sub Topic

Overview of DfE Tools and Resources
20 minutes

Specific Outcomes

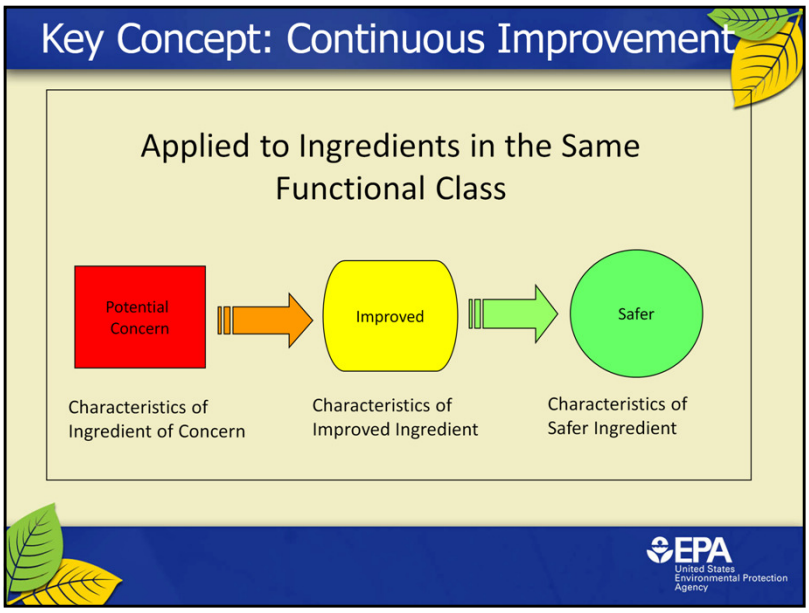
Increased use of resources to identify safer chemical alternatives, thereby reducing hazardous substance usage.

Notes for the Facilitator

Say: The functionality of a chemical is the job it performs in a formulation, material or product; its function is related to the chemical structure and physical chemical properties. Comparing alternatives that perform similar functions is a key concept in identifying safer alternatives.

Examples of functional use classes for chemicals include:

- Surfactants
- Solvents
- Plasticizers
- Colorants
- Anti-oxidants
- Stabilizers
- Processing aids



Sub Topic

Overview of DfE Tools and Resources
20 minutes

Specific Outcomes

Increased use of resources to identify safer chemical alternatives, thereby reducing hazardous substance usage.

Notes for the Facilitator

Key Point: This slide highlights the key concept of continuous improvement.

Safer Product Labeling Program
• Promote use of safer chemicals in formulated products
• Review every ingredient by functional use class
• Review formulation as a whole
• 3-year certification
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Sub Topic

Overview of DfE Tools and Resources
20 minutes

Specific Outcomes

Increased use of resources to identify safer chemical alternatives, thereby reducing hazardous substance usage.

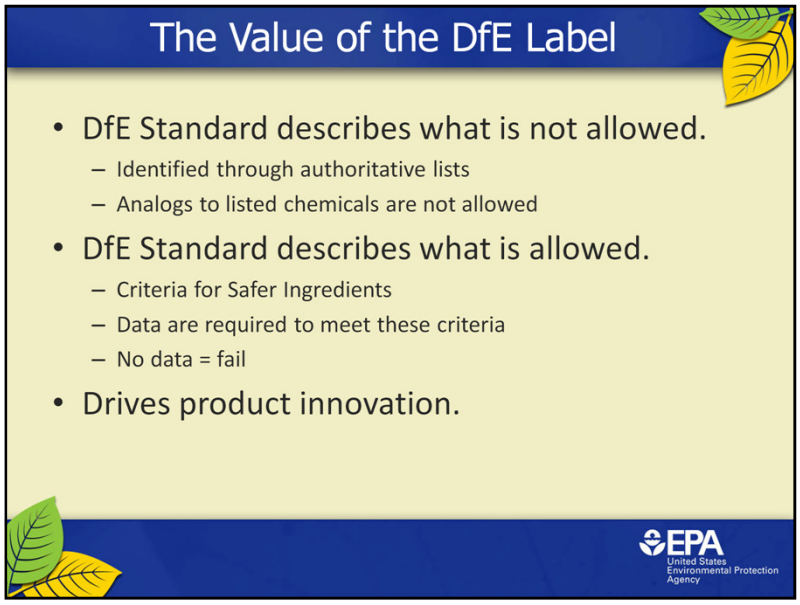
Notes for the Facilitator

Say: The Safer Product Labeling Program, which partners with manufacturers, is a voluntary program that recognizes products that are high-performance and cost-effective using the safest chemical ingredients. To earn the DfE label, products undergo a review of every ingredient in a given product. Products are reviewed by functional use class and on a pass/fail basis against established criteria."

Background Information: Partners in the program agree to use the DfE logo on all reviewed products and agree to annual audits. DfE has reviewed over 2700 products from more than 500 manufacturers.

The review formulation includes:

- Synergistic effects
- pH
- Performance testing


The Value of the DfE Label
• DfE Standard describes what is not allowed.
– Identified through authoritative lists
– Analogs to listed chemicals are not allowed
• DfE Standard describes what is allowed.
– Criteria for Safer Ingredients
– Data are required to meet these criteria
– No data = fail
• Drives product innovation.
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Sub Topic

Overview of DfE Tools and Resources
20 minutes

Specific Outcomes

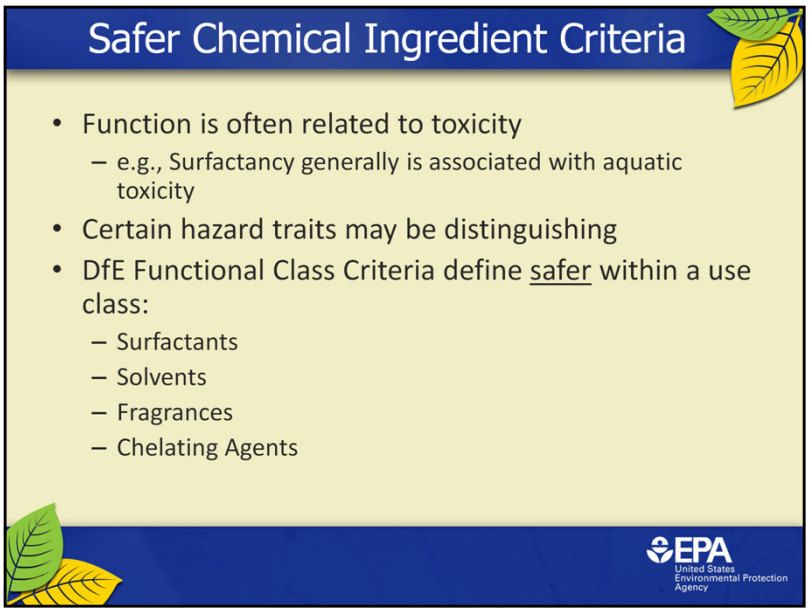
Increased use of resources to identify safer chemical alternatives, thereby reducing hazardous substance usage.

Notes for the Facilitator

Say: The DfE label establishes a standard for products and their components, controlling for what is and isn't permissible when seeking the DfE label.

Instructions: Briefly discuss what the standard allows and doesn't allow.

Say: Beyond reviewing products, the program is designed to facilitate product/chemical innovation. The goal is to effectively drive suppliers and manufacturers to develop safer chemicals and accompanying test data for biodegradation, carcinogenicity, aquatic toxicity, etc.


Safer Chemical Ingredient Criteria
• Function is often related to toxicity
– e.g., Surfactancy generally is associated with aquatic toxicity
• Certain hazard traits may be distinguishing
• DfE Functional Class Criteria define safer within a use class:
– Surfactants
– Solvents
– Fragrances
– Chelating Agents
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Sub Topic

Overview of DfE Tools and Resources
20 minutes

Specific Outcomes

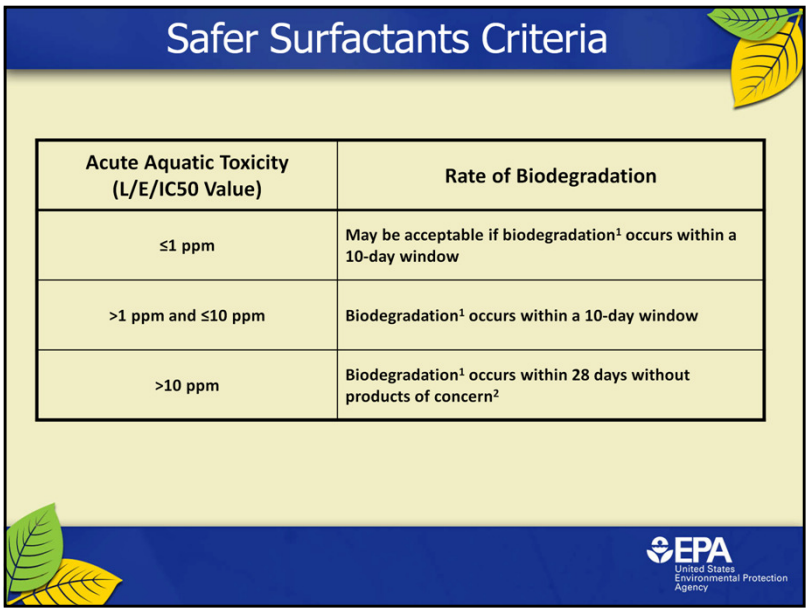
Increased use of resources to identify safer chemical alternatives, thereby reducing hazardous substance usage.

Notes for the Facilitator

Say: "Acute aquatic toxicity increases exponentially with increases in the hydrophobic chain length when the number of ethoxy groups or the hydrophilic component is held constant." -- EPA OPPT New Chemicals Category for nonionic surfactants

"All detergents destroy the external mucus layers that protect the fish from bacteria and parasites; plus they can cause severe damage to the gills."

Online Resource: More information can be found at:
http://www.lenntech.com/aquatic/detergents.htm#ixzz1xpD5ElCR


Safer Surfactants Criteria
Acute Aquatic Toxicity (L/E/IC50 Value)
Rate of Biodegradation
≤1 ppm
May be acceptable if biodegradation[1] occurs within a 10-day window
>1 ppm and ≤10 ppm
Biodegradation[1] occurs within a 10-day window
>10 ppm
Biodegradation[1] occurs within 28 days without products of concern[2]
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Sub Topic

Overview of DfE Tools and Resources
20 minutes

Specific Outcomes

Increased use of resources to identify safer chemical alternatives, thereby reducing hazardous substance usage.

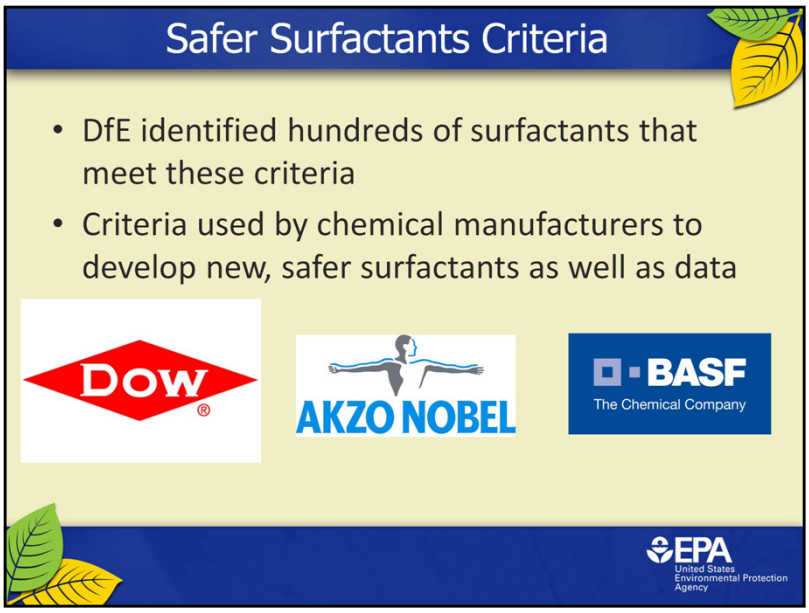
Notes for the Facilitator

Instructions: This slide provides an example rate of acute aquatic toxicity as it relates to rates of biodegradation, and provides a range of toxicity based on varying rate of biodegradation.

Say: Safer surfactants degrade quickly to low toxicity degradates.

Background Information: the footnotes on the slide refer to the following:
[1] Generally, >60% mineralization (to CO2 and water) in 28 days.
[2] Products of concern are compounds with high acute aquatic toxicity (L/E/IC50 ≤ 10ppm) and a slow rate of
biodegradation (greater than 28 days).

P2: On the Path to Greener Chemistry


Safer Surfactants Criteria
• DfE identified hundreds of surfactants that meet these criteria
• Criteria used by chemical manufacturers to develop new, safer surfactants as well as data
DOW
AKZO NOBEL
BASF
The Chemical Company
EPA
United States Environmental Protection Agency

Sub Topic

Overview of DfE Tools and Resources
20 minutes

Specific Outcomes

Increased use of resources to identify safer chemical alternatives, thereby reducing hazardous substance usage.

Notes for the Facilitator

Say: The safer surfactants criteria has been used by DfE to evaluate and identify safer alternatives. Chemical manufacturers have also used the criteria to design new surfactants and develop critical data needed to understand the relative preferability of surfactants.

P2: On the Path to Greener Chemistry

Safer Chemical Ingredient List
About Us
About the DfE Label
Labeled Products
DfE Projects
Resources
Design for the Environment
An EPA Partnership Program
U.S. EPA
You are here: EPA Home > DfE > Safer Chemical Ingredients for Use in DfE-Labeled Products
Safer Chemical Ingredients for Use in DfE-Labeled Products
The Safer Chemical Ingredients List contains chemicals that meet the criteria of the Design for the Environment (DfE) Safer Product Labeling Program. This voluntary program recognizes products that are high-performance and cost-effective using the safest chemical ingredients. At present, more than 2,800 products carry the DfE Safer Product Label. This list of safer chemical ingredients is arranged by functional-use class and will assist product manufacturers in identifying chemicals that the DfE program has already evaluated and identified as safer.
DfE's Safer Chemical Ingredients List
About the List
Additional Resources
DfE's Safer Chemical Ingredients List
Safer Chemical Ingredients for Use in DfE-Labeled Products
The listed chemicals are safer alternatives, grouped by their functional-use class.
Chemicals are marked as a green circle, a green half-circle, or a yellow triangle.
This list includes many of the chemicals evaluated through the DfE Safer Product Labeling Program. It does not include confidential chemicals and does not yet include fragrance chemicals. There may be chemicals not included in this list that are also safer.
Chelating Agents
Colorants
Defoamers
Enzymes and Enzyme Stabilizers
Top DfE Questions
Frequently Asked Questions
Where can I find a list of products with the DfE label?
How do I apply to get the DfE label on my products?
EPA
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Sub Topic

Overview of DfE Tools and Resources
20 minutes

Specific Outcomes

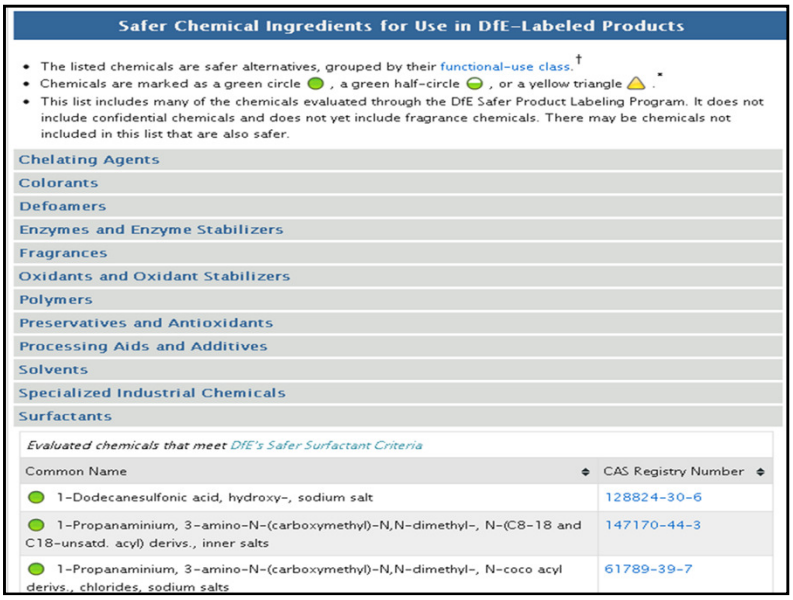
Increased use of resources to identify safer chemical alternatives, thereby reducing hazardous substance usage.

Notes for the Facilitator

Online Resource: Navigate to the Safer Chemical Ingredients List: http://www.epa.gov/dfe/saferingredients.htm

Say: This list contains chemicals that meet the functional class criteria of the Design for the Environment (DfE) Safer Product Labeling Program. This list of safer chemical ingredients is arranged by functional-use class such as surfactants, solvents, and fragrances.

P2: On the Path to Greener Chemistry



Safer Chemical Ingredients for Use in DfE-Labeled Products

- The listed chemicals are safer alternatives, grouped by their functional-use class.†
- Chemicals are marked as a green circle, a green half-circle, or a yellow triangle.*
- This list includes many of the chemicals evaluated through the DfE Safer Product Labeling Program. It does not include confidential chemicals and does not yet include fragrance chemicals. There may be chemicals not included in this list that are also safer.

Chelating Agents
Colorants
Defoamers
Enzymes and Enzyme Stabilizers
Fragrances
Oxidants and Oxidant Stabilizers
Polymers
Preservatives and Antioxidants
Processing Aids and Additives
Solvents
Specialized Industrial Chemicals
Surfactants

Evaluated chemicals that meet DfE's Safer Surfactant Criteria

Common Name	CAS Registry Number
1-Dodecanesulfonic acid, hydroxy-, sodium salt	128824-30-6
1-Propanaminium, 3-amino-N-(carboxymethyl)-N,N-dimethyl-, N-(C8-18 and C18-unsatd. acyl) derivs., inner salts	147170-44-3
1-Propanaminium, 3-amino-N-(carboxymethyl)-N,N-dimethyl-, N-coco acyl derivs., chlorides, sodium salts	61789-39-7

Sub Topic

Overview of DfE Tools and Resources
20 minutes

Specific Outcomes

Increased use of resources to identify safer chemical alternatives, thereby reducing hazardous substance usage.

Notes for the Facilitator

Online Resource: Navigate to the Safer Chemical Ingredients List: http://www.epa.gov/dfe/saferingredients.htm

Key Point: This list can be used in identifying chemicals that the DfE program has already evaluated and identified as safer.
The listed chemicals are safer alternatives, grouped by their functional use and are marked with a green circle, a green half-circle, or a yellow triangle.

- Green circle - The chemical has been verified to be of low concern based on experimental and modeled data.
- Green half-circle - The chemical is expected to be of low concern based on experimental and modeled data. Additional data would strengthen our confidence in the chemical's safer status.
- Yellow triangle - The chemical has met DfE criteria for its functional ingredient-class, but has some hazard profile issues. Specifically, a chemical with this code is not associated with a low level of hazard concern for all human health and environmental endpoints. While it is a best-in-class chemical and among the safest available for a particular function, the function fulfilled by the chemical should be considered an area for safer chemistry innovation (continuous improvement).

Discussion Question: Which tools identified in this training module could complement your current approach in identifying safer chemical alternatives to achieve greater hazardous substances reductions?

P2: On the Path to Greener Chemistry

Sub Topic

Overview of DfE Tools and Resources
20 minutes

Specific Outcomes

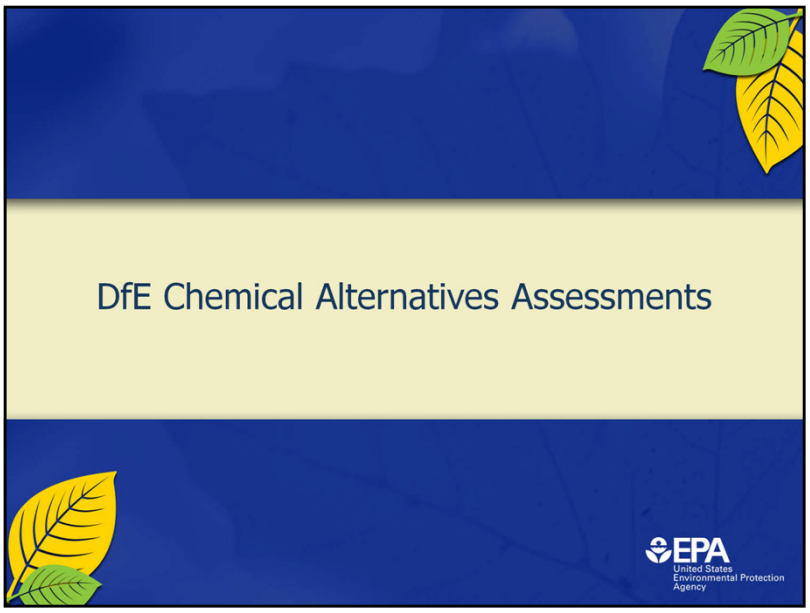
Increased use of resources to identify safer chemical alternatives, thereby reducing hazardous substance usage.

Notes for the Facilitator

Say: EPA allows safer products to carry the Design for the Environment (DfE) label. This mark allows consumers to quickly identify and choose products that can help protect the environment and are safer for families. When you see the DfE logo on a product it means that the DfE scientific review team has screened each ingredient for potential human health and environmental effects and that—based on the best currently available information, EPA predictive models, and expert judgment—the product contains only those ingredients that pose the least concern among chemicals in their class.

Product manufacturers who become Design for the Environment partners and earn the right to display the Design for the Environment logo on recognized products have invested heavily in research, development and reformulation, to ensure that their ingredients and finished product line up on the green end of the health and environmental spectrum, while maintaining or improving product performance. The Design for the Environment label is recognized by retailers as a mark of environmental preferability.

EPA uses rigorous criteria to ensure that Design for the Environment-labeled products are safer for human health and the environment. The Design for the Environment label makes it easy for industrial and institutional purchasers and users to quickly identify safer chemical products that do not sacrifice quality or performance. Design for the Environment has approved more than 1,000 industrial and institutional products.



Sub Topic

DfE Chemical Alternative Assessments
15 minutes
(Elapsed Time: 35 minutes)

Specific Outcomes

Increased understanding of the DfE assessment approach for developing safer chemical alternatives.

Notes for the Facilitator

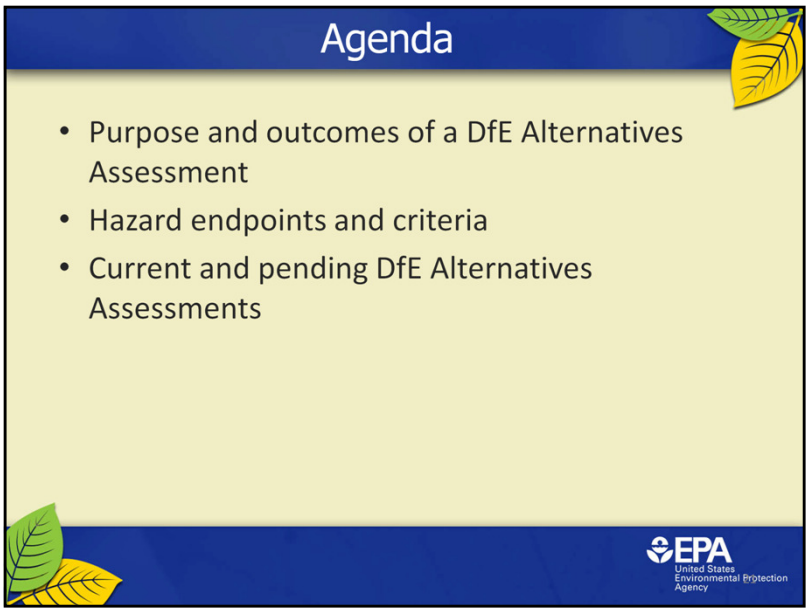
Say: This is the first slide of a series that focus on tools that can be used in support of hazardous substance pollution prevention assessments.

Topics

- DfE Chemical Alternative Assessments

Desired Outcomes

- Increased understanding of the DfE assessment approach for developing safer chemical alternatives.


Agenda
• Purpose and outcomes of a DfE Alternatives Assessment
• Hazard endpoints and criteria
• Current and pending DfE Alternatives Assessments
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Sub Topic

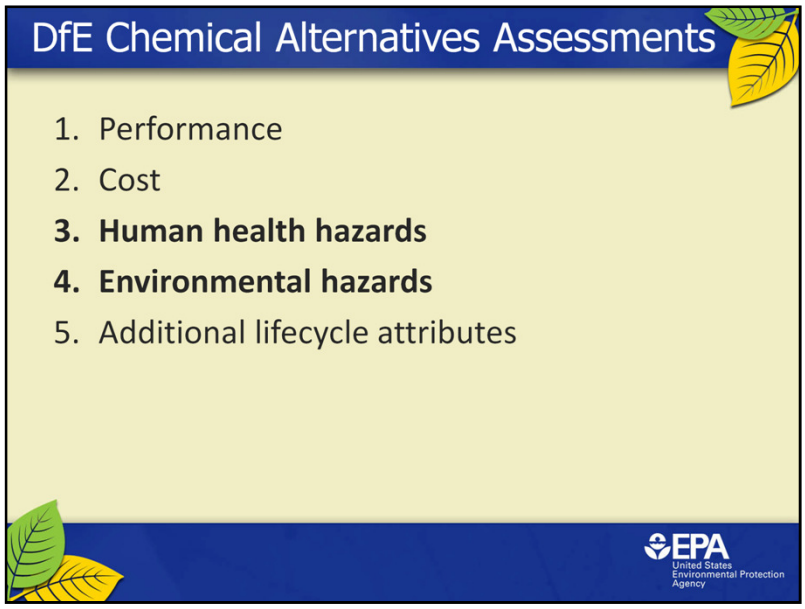
DfE Chemical Alternative Assessments
15 minutes
(Elapsed Time: 35 minutes)

Specific Outcomes

Increased understanding of the DfE assessment approach for developing safer chemical alternatives.

Notes for the Facilitator

Say: DfE's Alternatives Assessment Program helps industries choose safer chemicals for applications. Alternatives assessments characterize chemical hazards based on a full range of human health and environmental information. Chemical choices made based on these assessments can minimize the potential for unintended consequences that might occur in moving from a potentially problematic chemical to a poorly understood alternative, which could be more hazardous.



Sub Topic

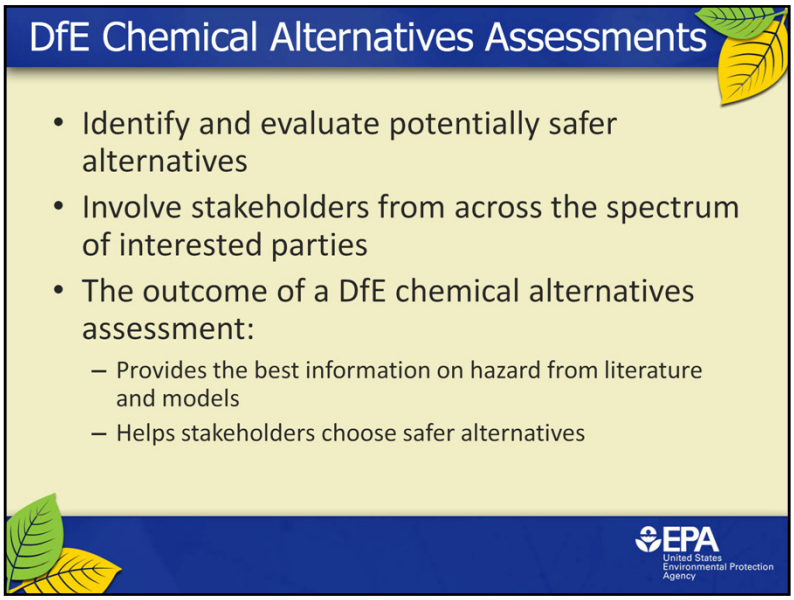
DfE Chemical Alternative Assessments
15 minutes
(Elapsed Time: 35 minutes)

Specific Outcomes

Increased understanding of the DfE assessment approach for developing safer chemical alternatives.

Notes for the Facilitator

Say: Aspects of all of these attributes are included in a DfE Chemical Alternatives Assessments. Stakeholders often provide information on performance and cost, and other lifecycle attributes. Health and environmental data from chemical suppliers may also be gathered. DfE's primary role is the assessment of available data, so that complex toxicological studies can be summarized in a straightforward way. This allows those who are not toxicologists or otherwise familiar with such test data to incorporate this information into their decision-making.


DfE Chemical Alternatives Assessments
• Identify and evaluate potentially safer alternatives
• Involve stakeholders from across the spectrum of interested parties
• The outcome of a DfE chemical alternatives assessment:
– Provides the best information on hazard from literature and models
– Helps stakeholders choose safer alternatives
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Sub Topic

DfE Chemical Alternative Assessments
15 minutes
(Elapsed Time: 35 minutes)

Specific Outcomes

Increased understanding of the DfE assessment approach for developing safer chemical alternatives.

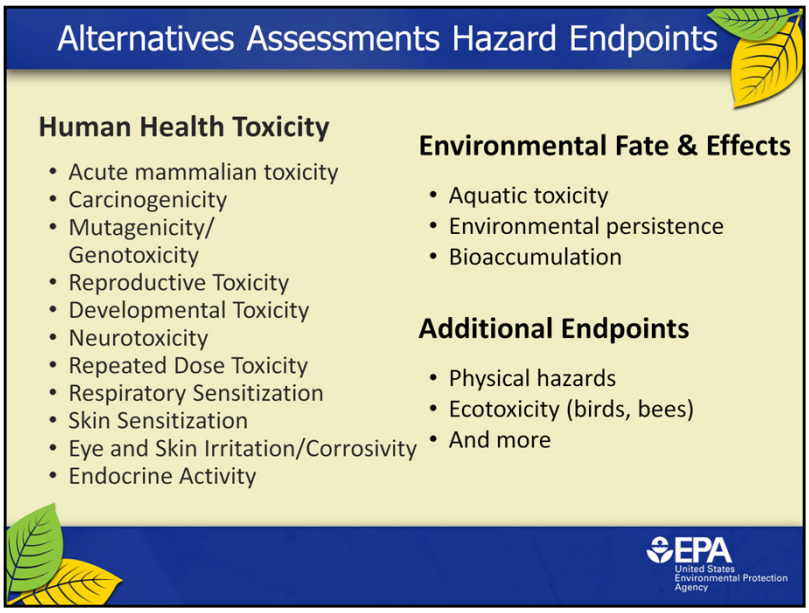
Notes for the Facilitator

Say: Providing information to decision-makers that will promote informed chemical substitution and minimize unintended consequences from these substitutes.

Typically all of the endpoints are used in an alternatives assessment. Each is ranked either high, medium, or low based either on thresholds (if data are available) or evidence (certain endpoints such as C and M, but also chemicals that lack data or analogs).

The outcomes of a DfE chemical alternatives assessment are:

- Providing information that manufacturers can use to create more sustainable products.
- Helping minimize the potential for unintended consequences by reducing the likelihood of moving to alternatives that could pose a concern.



Sub Topic

DfE Chemical Alternative Assessments
15 minutes
(Elapsed Time: 35 minutes)

Specific Outcomes

Increased understanding of the DfE assessment approach for developing safer chemical alternatives.

Notes for the Facilitator

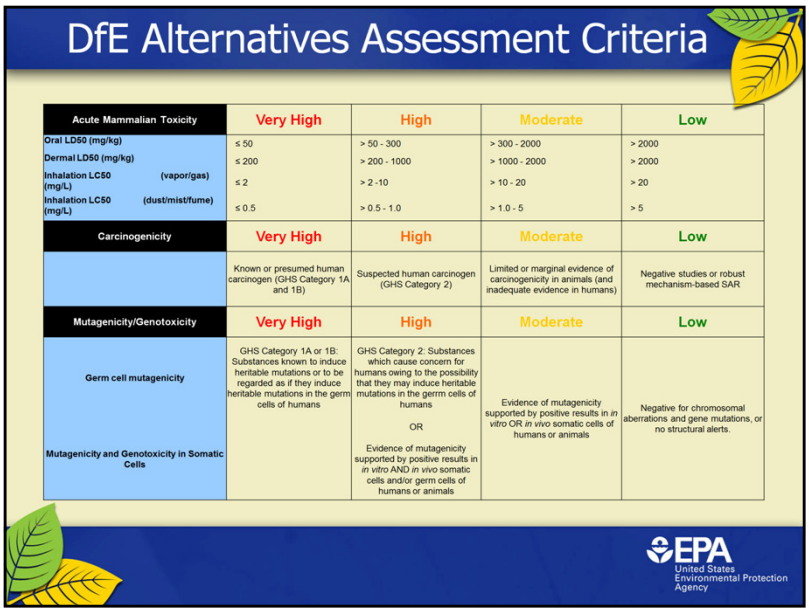
Say: This slide lists common, internationally agreed upon endpoints for characterizing hazards. These hazard endpoints are taken from international and other EPA precedents. These represent common toxicological endpoints used to characterize the potential hazards of chemicals

In the current version 2.0 of the Alternatives Assessment Criteria, the endpoints from earlier assessments were added to the list of endpoints. Acute toxicity is new as is respiratory sensitization, eye and skin irritation/corrosivity, and endocrine activity. This last endpoint is not a hazard endpoint. Rather it's an informational endpoint and the focus is on assessing evidence for the presence or absence of endocrine activity, defined as a change in endocrine homeostasis caused by a chemical or other stressor from human activities. We will not try to characterize this endpoint in terms of "hazard".

These additional endpoints (such as explosivity) could be added to an alternatives assessment, if they are relevant to the chemicals in question, and data are generally available.

Background Information: DfE does not try to characterize endocrine activity in terms of "hazard", in part because the science is still emerging so it is difficult to determine when a change in activity results in harm, but also because we do not expect to have complete data on most chemicals evaluated, thus it is likely to be difficult to evaluate endocrine-associated hazards based on a patchwork of data.

P2: On the Path to Greener Chemistry


DfE Alternatives Assessment Criteria
Acute Mammalian Toxicity
Very High
High
Moderate
Low
Oral LD50 (mg/kg)
≤ 50
> 50 - 300
> 300 - 2000
> 2000
Dermal LD50 (mg/kg)
≤ 200
> 200 - 1000
> 1000 - 2000
> 2000
Inhalation LC50 (vapor/gas) (mg/L)
≤ 2
> 2 -10
> 10 - 20
> 20
Inhalation LC50 (dust/mist/fume) (mg/L)
≤ 0.5
> 0.5 - 1.0
> 1.0 - 5
> 5
Carcinogenicity
Very High
High
Moderate
Low
Known or presumed human carcinogen (GHS Category 1A and 1B)
Suspected human carcinogen (GHS Category 2)
Limited or marginal evidence of carcinogenicity in animals (and inadequate evidence in humans)
Negative studies or robust mechanism-based SAR
Mutagenicity/Genotoxicity
Very High
High
Moderate
Low
Germ cell mutagenicity
GHS Category 1A or 1B: Substances known to induce heritable mutations or to be regarded as if they induce heritable mutations in the germ cells of humans
GHS Category 2: Substances which cause concern for humans owing to the possibility that they may induce heritable mutations in the germ cells of humans
OR
Evidence of mutagenicity supported by positive results in in vitro AND in vivo somatic cells and/or germ cells of humans or animals
Evidence of mutagenicity supported by positive results in in vitro OR in vivo somatic cells of humans or animals
Negative for chromosomal aberrations and gene mutations, or no structural alerts.
Mutagenicity and Genotoxicity in Somatic Cells
EPA
United States Environmental Protection Agency

Sub Topic

DfE Chemical Alternative Assessments
15 minutes
(Elapsed Time: 35 minutes)

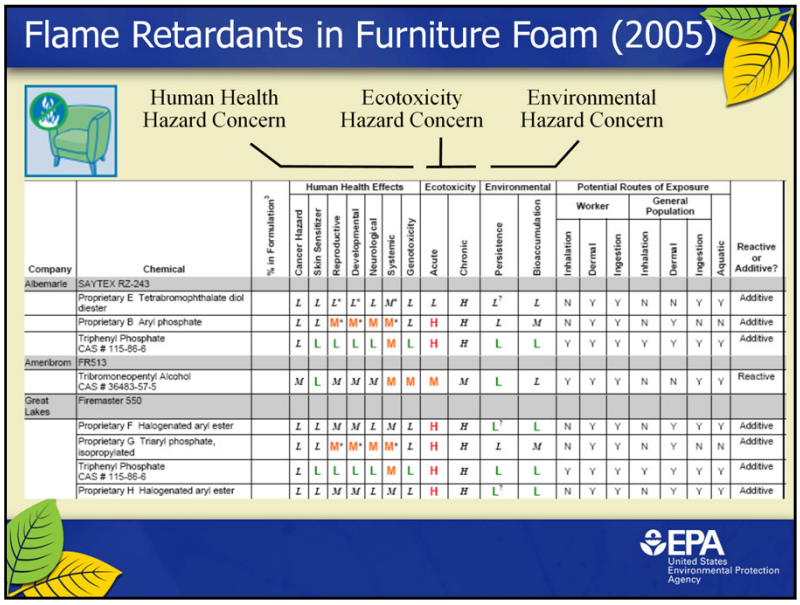
Specific Outcomes

Increased understanding of the DfE assessment approach for developing safer chemical alternatives.

Notes for the Facilitator

Online Resource: The full document is available at: www.epa.gov/alternatives_assessments.

P2: On the Path to Greener Chemistry



Company	Chemical	% in Formulation[3]	Human Health Effects: Cancer Hazard	Skin Sensitizer	Reproductive	Developmental	Neurological	Systemic	Genotoxicity	Ecotoxicity: Acute	Chronic	Environmental: Persistence	Bioaccumulation	Potential Routes of Exposure: Worker: Inhalation	Worker: Dermal	Worker: Ingestion	General Population: Inhalation	General Population: Dermal	General Population: Ingestion	Aquatic	Reactive or Additive?
Albemarle	SAYTEX RZ-243																				
	Proprietary E Tetrabromophthalate diol diester		*L*	*L*	*L**	*L**	*L*	*M**	*L*	*L*	*H*	*L*[7]	*L*	N	Y	Y	N	N	Y	Y	Additive
	Proprietary B Aryl phosphate		*L*	*L*	M*	M*	M	M*	*L*	H	*H*	*L*	*M*	N	Y	Y	N	Y	N	N	Additive
	Triphenyl Phosphate CAS # 115-86-6		*L*	L	L	L	L	M	L	H	*H*	L	L	Y	Y	Y	Y	Y	Y	Y	Additive
Ameribrom	FR513																				
	Tribromoneopentyl Alcohol CAS # 36483-57-5		*M*	L	*M*	*M*	*M*	M	M	M	*M*	L	*L*	Y	Y	Y	N	N	Y	Y	Reactive
Great Lakes	Firemaster 550																				
	Proprietary F Halogenated aryl ester		*L*	*L*	*M*	*M*	*L*	*M*	*L*	H	*H*	L[7]	L	N	Y	Y	N	Y	Y	Y	Additive
	Proprietary G Triaryl phosphate, isopropylated		*L*	*L*	M*	M*	M	M*	*L*	H	*H*	*L*	*M*	N	Y	Y	N	Y	N	N	Additive
	Triphenyl Phosphate CAS # 115-86-6		*L*	L	L	L	L	M	L	H	*H*	L	L	Y	Y	Y	Y	Y	Y	Y	Additive
	Proprietary H Halogenated aryl ester		*L*	*L*	*M*	*M*	*L*	*M*	*L*	H	*H*	L[7]	L	N	Y	Y	N	Y	Y	Y	Additive

Sub Topic

DfE Chemical Alternative Assessments
15 minutes
(Elapsed Time: 35 minutes)

Specific Outcomes

Increased understanding of the DfE assessment approach for developing safer chemical alternatives.

Notes for the Facilitator

Instructions: Highlight what was done well:

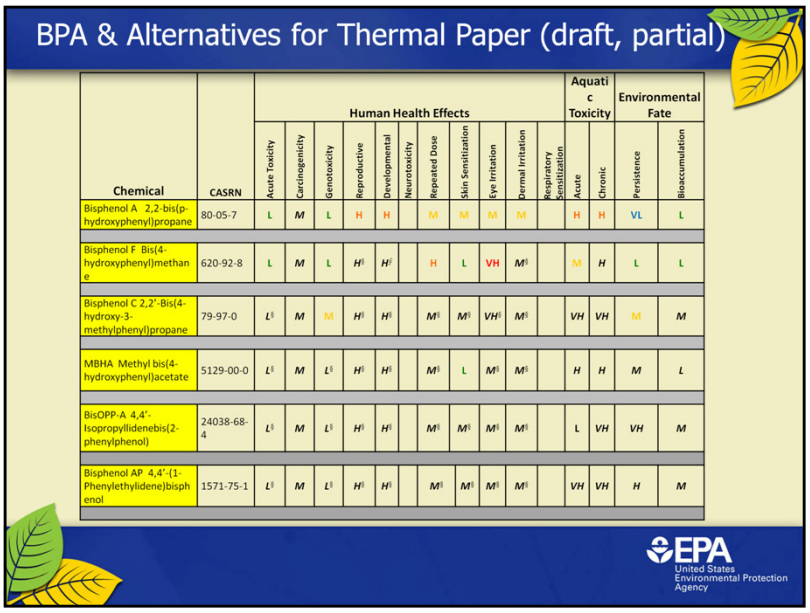
- Used many of the standard human health and environmental hazard concerns that are regularly used to characterize chemicals.
- Evaluated data on each constituent of the flame retardant, and gave the chemical a low, moderate, or high hazard designation based on the data for each endpoint.
- Noted higher confidence in the assessment by using bold letters; for lower confidence, black, italic letters are used.

Background Information: The criteria were not sufficiently transparent (used NCP criteria). Some of the criteria, for example Systemic Toxicity, did not provide sufficient discriminatory power. As a result, all chemicals were given a "moderate" for systemic toxicity. Recognize that the criteria not reflecting some of the subtleties that would distinguish these chemicals?

Through past and current projects, DfE has demonstrated the power of comparative chemical hazard assessment. But the method can only be adopted by other organizations if it's sufficiently transparent.

- DfE completed its first Alternatives Assessment nearly six years ago.
- It used New Chemicals Program (NCP) criteria to define low, moderate, or high hazard designation. NCP criteria are well understood within EPA, but less transparent to those outside of EPA.
- Documented the criteria that define these designations.
- distinguish based on the chemical's potential not just to cause an adverse effect, but also the potency at which those effects occur.

P2: On the Path to Greener Chemistry



BPA & Alternatives for Thermal Paper (draft, partial)

Chemical	CASRN	Human Health Effects											Aquatic Toxicity		Environmental Fate	
		Acute Toxicity	Carcinogenicity	Genotoxicity	Reproductive	Developmental	Neurotoxicity	Repeated Dose	Skin Sensitization	Eye Irritation	Dermal Irritation	Respiratory Sensitization	Acute	Chronic	Persistence	Bioaccumulation
Bisphenol A 2,2-bis(p-hydroxyphenyl)propane	80-05-7	L	M	L	H	H		M	M	M	M		H	H	VL	L
Bisphenol F Bis(4-hydroxyphenyl)methane	620-92-8	L	M	L	H§	H§		H	L	VH	M§		M	H	L	L
Bisphenol C 2,2'-Bis(4-hydroxy-3-methylphenyl)propane	79-97-0	L§	M	M	H§	H§		M§	M§	VH§	M§		VH	VH	M	M
MBHA Methyl bis(4-hydroxyphenyl)acetate	5129-00-0	L§	M	L§	H§	H§		M§	L	M§	M§		H	H	M	L
BisOPP-A 4,4'-Isopropyllidenebis(2-phenylphenol)	24038-68-4	L§	M	L§	H§	H§		M§	M§	M§	M§		L	VH	VH	M
Bisphenol AP 4,4'-(1-Phenylethylidene)bisphenol	1571-75-1	L§	M	L§	H§	H§		M§	M§	M§	M§		VH	VH	H	M

Sub Topic

DfE Chemical Alternative Assessments
15 minutes
(Elapsed Time: 35 minutes)

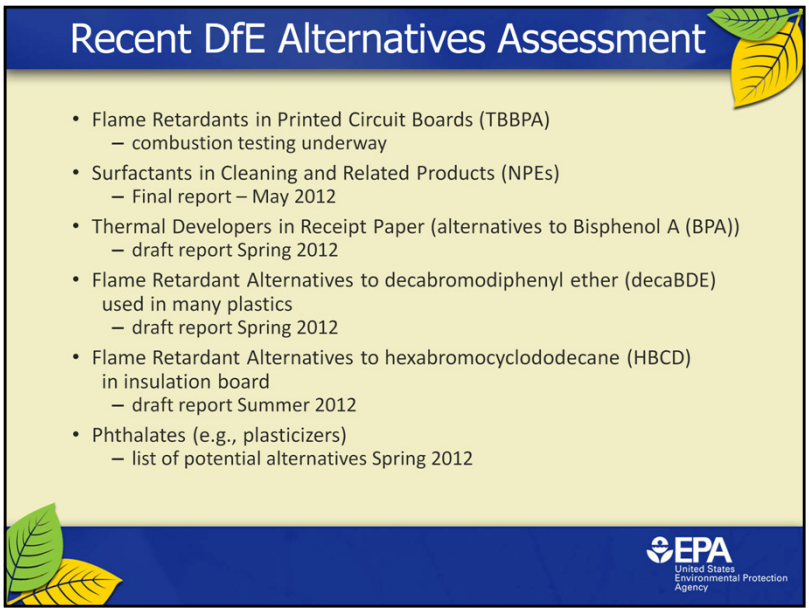
Specific Outcomes

Increased understanding of the DfE assessment approach for developing safer chemical alternatives.

Notes for the Facilitator

Say: Alternatives Assessments identify potential alternatives:

- Some may be safer
- Some may be associated with trade-offs
- In some cases green chemistry alternatives are not identified
- BPA alternatives have important trade-offs:
- No “true green” alternative identified
- Concerns must be balanced, considering use
- Alternative approaches should be considered:
- Complete redesign – green chemistry & sustainability principles
- E-receipts
- Alternative printer technologies


Recent DfE Alternatives Assessment
• Flame Retardants in Printed Circuit Boards (TBBPA)
– combustion testing underway
• Surfactants in Cleaning and Related Products (NPEs)
– Final report – May 2012
• Thermal Developers in Receipt Paper (alternatives to Bisphenol A (BPA))
– draft report Spring 2012
• Flame Retardant Alternatives to decabromodiphenyl ether (decaBDE) used in many plastics
– draft report Spring 2012
• Flame Retardant Alternatives to hexabromocyclododecane (HBCD) in insulation board
– draft report Summer 2012
• Phthalates (e.g., plasticizers)
– list of potential alternatives Spring 2012
EPA
United States Environmental Protection Agency

Sub Topic

DfE Chemical Alternative Assessments
15 minutes
(Elapsed Time: 35 minutes)

Specific Outcomes

Increased understanding of the DfE assessment approach for developing safer chemical alternatives.

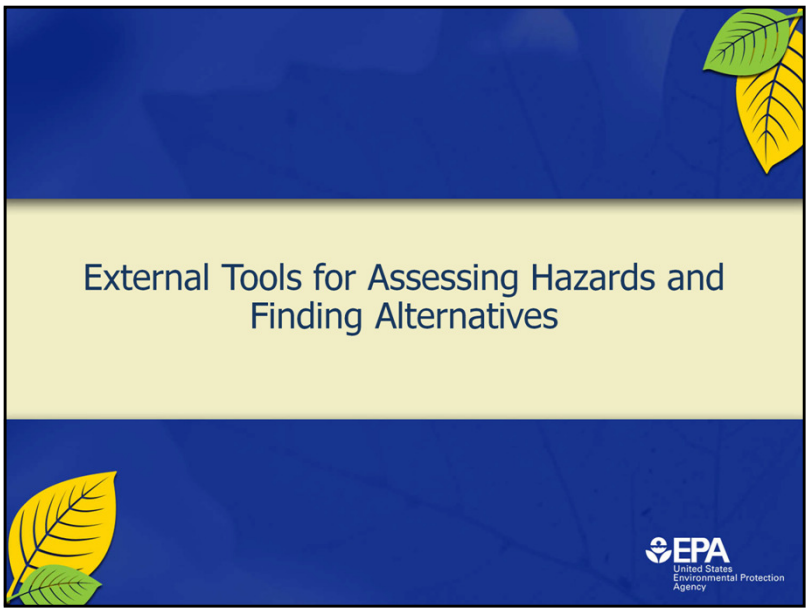
Notes for the Facilitator

Instructions: Discuss examples of DfE Alternative Assessments

Discussion Questions:

1) Which tools identified in this training module could complement your current approach in identifying safer chemical alternatives to achieve greater hazardous substances reductions?

2) What are the barriers and/or challenges your organization may face when adopting these tools into your current approach?



Sub Topic

External Tools for Assessing Hazards and Finding Alternatives
25 minutes
(Elapsed Time: 1 hour)

Specific Outcomes

Increased use of resources to identify safer chemical alternatives, thereby reducing hazardous substance usage.

Notes for the Facilitator

Say: This is the first slide of a series that focus on tools that can be used in support of hazardous substance pollution prevention assessments.

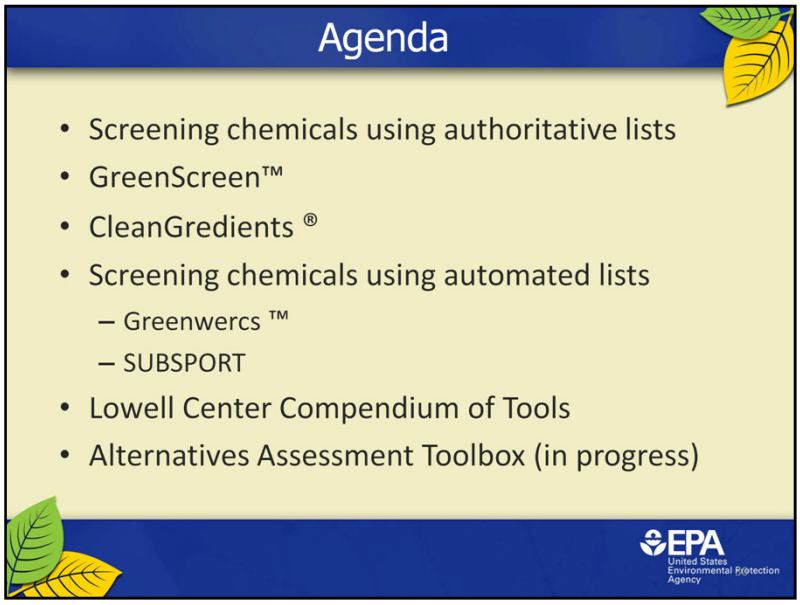
Note that many of the tools presented in this section have been developed in collaboration with EPA Design for the Environment Program.

Topics

- External Tools for Assessing Hazards and Finding Alternatives

Desired Outcomes

- Increased use of resources to identify safer chemical alternatives, thereby reducing hazardous substance usage.



Sub Topic

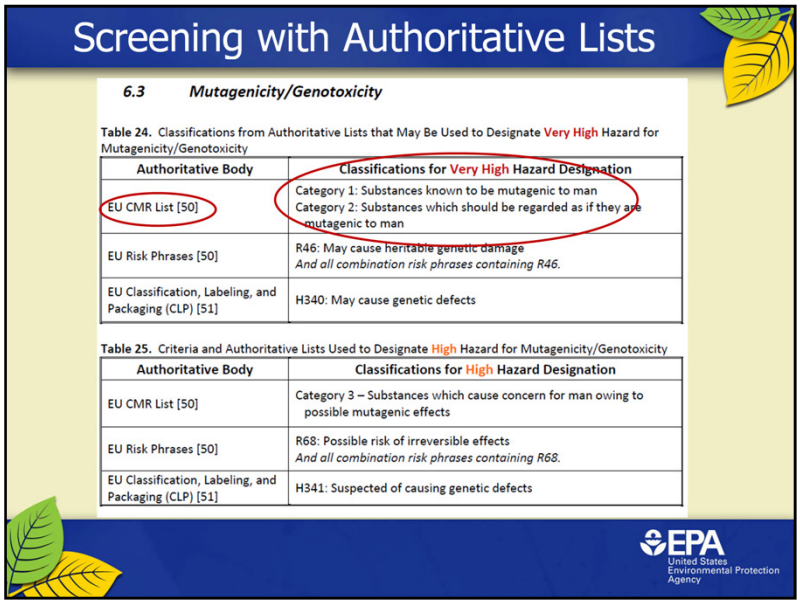
External Tools for Assessing Hazards and Finding Alternatives
25 minutes
(Elapsed Time: 1 hour)

Specific Outcomes

Increased use of resources to identify safer chemical alternatives, thereby reducing hazardous substance usage.

Notes for the Facilitator

Say: The rest of this module presents tools for assessing hazards and finding alternatives.


Screening with Authoritative Lists
6.3 Mutagenicity/Genotoxicity
Table 24. Classifications from Authoritative Lists that May Be Used to Designate Very High Hazard for Mutagenicity/Genotoxicity
Authoritative Body
Classifications for Very High Hazard Designation
EU CMR List [50]
Category 1: Substances known to be mutagenic to man
Category 2: Substances which should be regarded as if they are mutagenic to man
EU Risk Phrases [50]
R46: May cause heritable genetic damage
And all combination risk phrases containing R46.
EU Classification, Labeling, and Packaging (CLP) [51]
H340: May cause genetic defects
Table 25. Criteria and Authoritative Lists Used to Designate High Hazard for Mutagenicity/Genotoxicity
Authoritative Body
Classifications for High Hazard Designation
EU CMR List [50]
Category 3 – Substances which cause concern for man owing to possible mutagenic effects
EU Risk Phrases [50]
R68: Possible risk of irreversible effects
And all combination risk phrases containing R68.
EU Classification, Labeling, and Packaging (CLP) [51]
H341: Suspected of causing genetic defects
EPA
United States Environmental Protection Agency

Sub Topic

External Tools for Assessing Hazards and Finding Alternatives
25 minutes
(Elapsed Time: 1 hour)

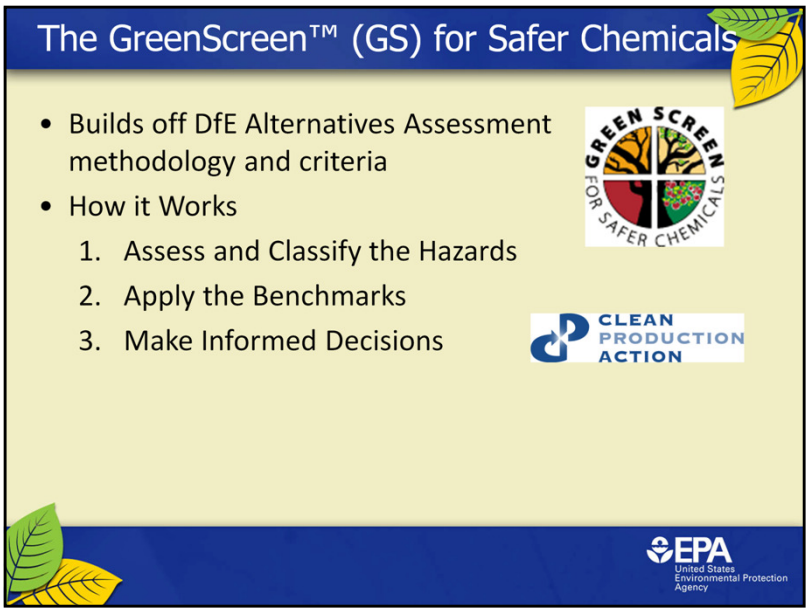
Specific Outcomes

Increased use of resources to identify safer chemical alternatives, thereby reducing hazardous substance usage.

Notes for the Facilitator

Say: EPA includes "authoritative lists" in its Alternatives Assessment Criteria. Authoritative lists typically come from governmental bodies, such as the EU CMR list provided in the slide. These lists provide information on the potential hazards of chemicals that have been received by a governmental or other authoritative organization. For example, the European Union identifies possible carcinogens (C), mutagens (M), and reproductive toxicants (R). These classifications are useful in understanding what is already known a bout a chemical.

Online Resources: EU CMR – European Union list of carcinogenic, mutagenic and toxic to reproduction substances.
http://ec.europa.eu/consumers/sectors/cosmetics/cosmetic-products/cmr/


The GreenScreen™ (GS) for Safer Chemicals
• Builds off DfE Alternatives Assessment methodology and criteria
• How it Works
1. Assess and Classify the Hazards
2. Apply the Benchmarks
3. Make Informed Decisions
GREEN SCREEN FOR SAFER CHEMICALS
CLEAN PRODUCTION ACTION
EPA United States Environmental Protection Agency

Sub Topic

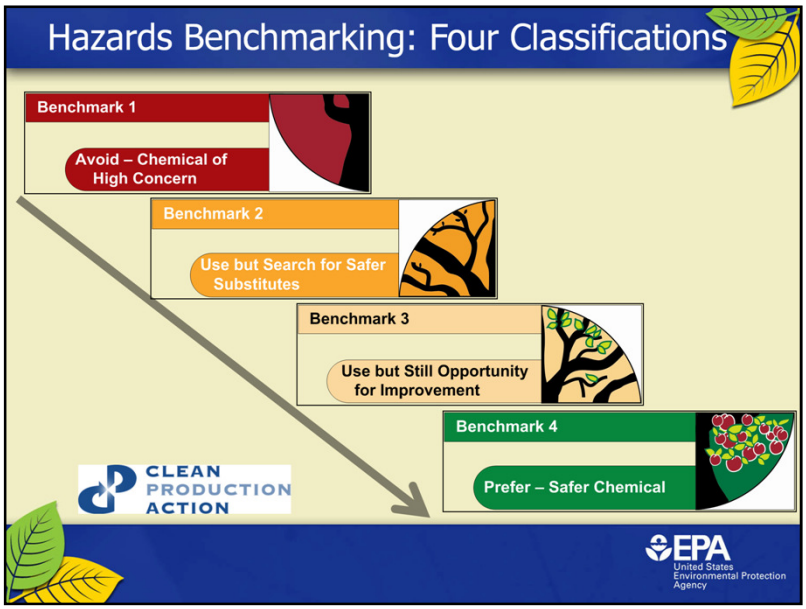
External Tools for Assessing Hazards and Finding Alternatives
25 minutes
(Elapsed Time: 1 hour)

Specific Outcomes

Increased use of resources to identify safer chemical alternatives, thereby reducing hazardous substance usage.

Notes for the Facilitator

Say: The GreenScreen is an open source tool developed by Clean Production Action, a non-profit focused on safer chemicals and sustainable materials. The GreenScreen builds off of the Design for the Environment alternatives assessment approach. Toxicological data are collected and evaluated using the GreenScreen criteria (which are similar to DfE criteria). Then benchmarks (described further on the next slide) are applied to determine the most preferable of the available alternatives. This is a robust tool that does require a fair amount of technical expertise to apply.



Sub Topic

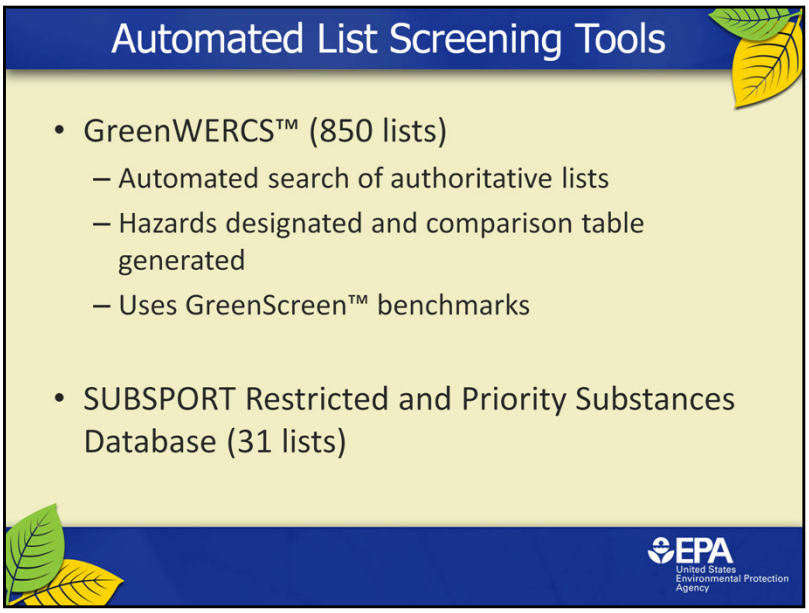
External Tools for Assessing Hazards and Finding Alternatives
25 minutes
(Elapsed Time: 1 hour)

Specific Outcomes

Increased use of resources to identify safer chemical alternatives, thereby reducing hazardous substance usage.

Notes for the Facilitator

Say: Chemicals are put into 4 categories using hazard benchmarks, which identify high hazard chemicals from 1 being the worst to 4 designating the best. The 1s are chemicals of high concern that you would want to potentially eliminate from your processes and emissions. As mentioned before, this aligns with global priorities.


Automated List Screening Tools
• GreenWERCS™ (850 lists)
– Automated search of authoritative lists
– Hazards designated and comparison table generated
– Uses GreenScreen™ benchmarks
• SUBSPORT Restricted and Priority Substances Database (31 lists)
EPA
United States Environmental Protection Agency

Sub Topic

External Tools for Assessing Hazards and Finding Alternatives
25 minutes
(Elapsed Time: 1 hour)

Specific Outcomes

Increased use of resources to identify safer chemical alternatives, thereby reducing hazardous substance usage.

Notes for the Facilitator

Say: Various non-profit and for-profit organizations have developed automated tools to screen authoritative lists. This slide highlights examples of automated list screening tools. The proceeding slides will highlight use of these tools.

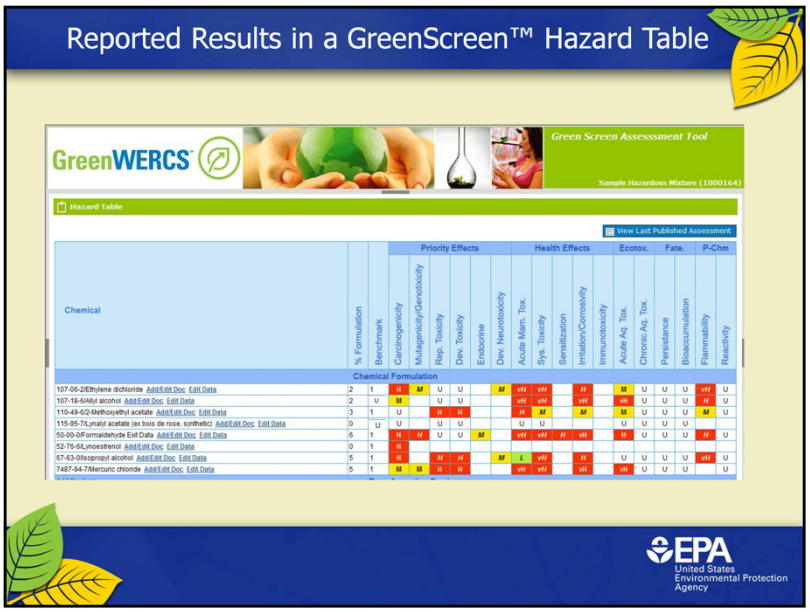
GreenWERCS™ - GreenWERCS™ analyzes the composition of individual products using ingredient data to examine its potential impact on human health and the environment. It uses a pre-identified scoring and weighting algorithm to provide information on the chemical ingredients of the products and indicate whether or not they include persistent, bioaccumulative and toxic substances (PBTs); carcinogens, mutagens or reproductive toxicants (CMRs); potential hazardous waste; and probable endocrine disrupters.

Once the product formulation is entered into the system, GreenWERCS™ provides a product's green score and a visual analysis on how its products rank and where the most immediate opportunities are to reformulate without hazardous chemicals. For more information visit http://www.thewercs.com/products-and-services/greenwercs

Online Resource: SUBSPORT – Substitution Support Portal "Moving towards safer alternatives", for more information visit
http://www.subsport.eu/

The goal of the SUBSPORT project is to develop an internet portal that constitutes a state-of-the-art resource on safer alternatives to the use of hazardous chemicals. It should be a source of not just information on alternative substances and technologies, but also of tools and guidance for substance evaluation and substitution management. The portal is intended to support companies in fulfilling substitution requirements of EU legislation, such as those specified under the REACH authorization procedure, the Water Framework Directive or the Chemical Agents Directive. In addition, the project aims to create a network of experts and stakeholders who are active in substitution.

P2: On the Path to Greener Chemistry



Sub Topic

External Tools for Assessing Hazards and Finding Alternatives
25 minutes
(Elapsed Time: 1 hour)

Specific Outcomes

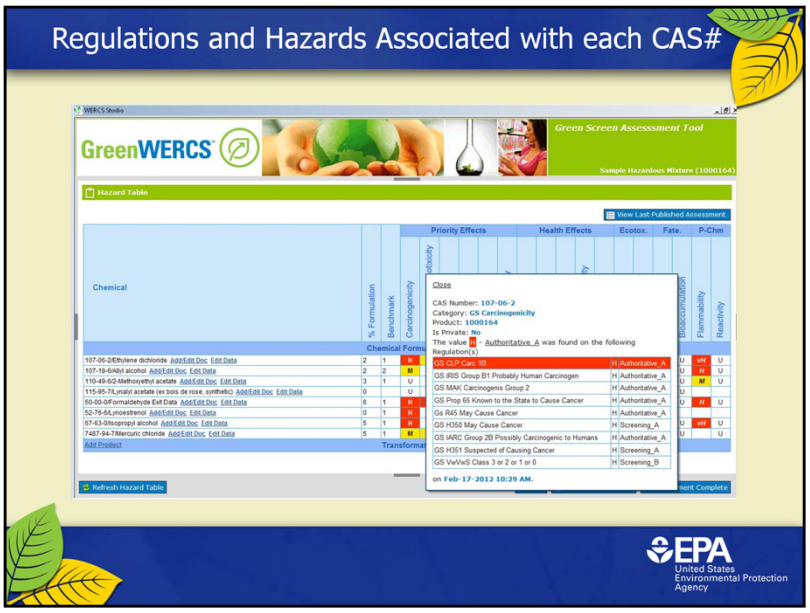
Increased use of resources to identify safer chemical alternatives, thereby reducing hazardous substance usage.

Notes for the Facilitator

Say: Results are reported in a GreenScreen™ hazard table and program benchmark logic is applied:

- It is difficult to do this. It is costly to do by chemical to chemical.
- The goal is that this is easier to do with GS LiTe, Set up in a hosted environment.
- No IT support is required
- Minimal user training is needed
- However, there is a monthly subscription fee

P2: On the Path to Greener Chemistry



Sub Topic

External Tools for Assessing Hazards and Finding Alternatives
25 minutes
(Elapsed Time: 1 hour)

Specific Outcomes

Increased use of resources to identify safer chemical alternatives, thereby reducing hazardous substance usage.

Notes for the Facilitator

Say: This screenshot shows an example of how users can navigate within the GreenWERCS data base. Within the database, users can highlight any box to view regulations and hazards associated with each Chemical Abstract Service number (CAS#).

P2: On the Path to Greener Chemistry

Sub Topic

External Tools for Assessing Hazards and Finding Alternatives
25 minutes
(Elapsed Time: 1 hour)

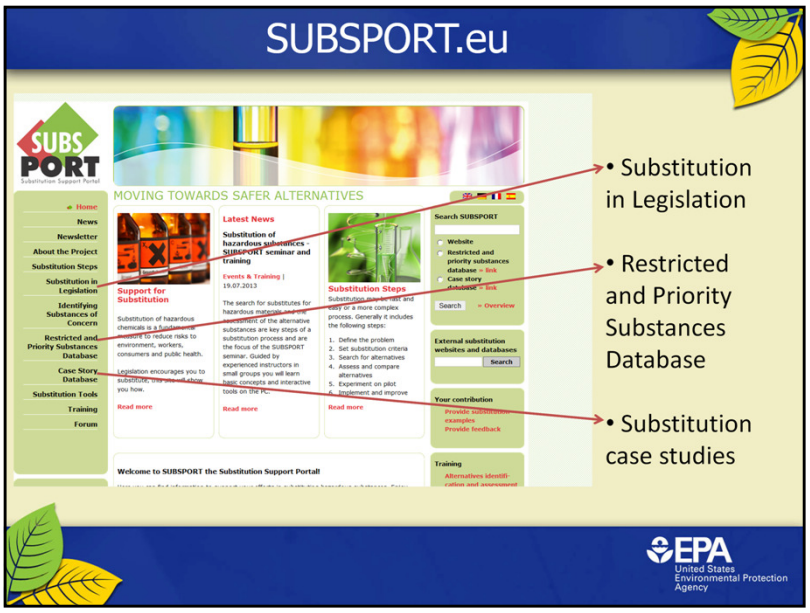
Specific Outcomes

Increased use of resources to identify safer chemical alternatives, thereby reducing hazardous substance usage.

Notes for the Facilitator

Say: Results can be generated in PDF reports that are easy to update.

P2: On the Path to Greener Chemistry



Sub Topic

External Tools for Assessing Hazards and Finding Alternatives
25 minutes
(Elapsed Time: 1 hour)

Specific Outcomes

Increased use of resources to identify safer chemical alternatives, thereby reducing hazardous substance usage.

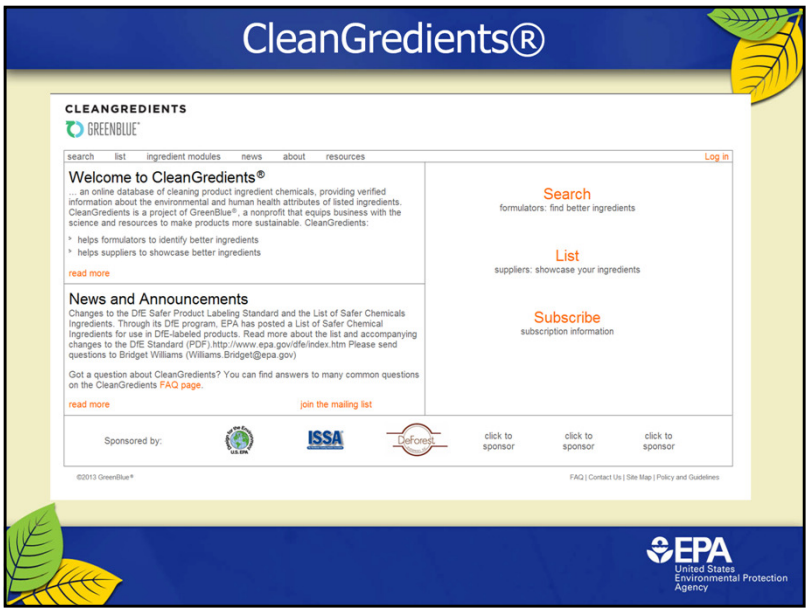
Notes for the Facilitator

Say: SUBSPORT is an online, user-friendly database providing information to support efforts in substituting hazardous substances. One way SUBSPORT can be used is to find case studies with general information on alternatives to use in place of hazardous substances. Region 5 successfully used SUBSPORT in this manner.

When searching for a safer chemical substitution for TCE for cleaning surfaces in Subsport, Region 5 quickly located a case study showing less toxic alternatives (water and soy based, natural abrasive materials, carbon dioxide and acetone) are as effective and less expensive than the typically used halogenated solvents for cleaning energized and non-energized equipment.

A summary of "Alternatives to Toxic, VOC, Ozone Depleting and Global Warming Energized Electrical Equipment Cleaners" can be found in your packet. It provides examples of the use of environmentally preferable alternates to halogenated solvents for cleaning electrical equipment at utilities. These alternatives may be useful in other general purpose cleaning applications.

P2: On the Path to Greener Chemistry


CleanGredients®
CLEANGREDIENTS
GREENBLUE
search list ingredient modules news about resources Log in
Welcome to CleanGredients®
... an online database of cleaning product ingredient chemicals, providing verified information about the environmental and human health attributes of listed ingredients. CleanGredients is a project of GreenBlue®, a nonprofit that equips business with the science and resources to make products more sustainable. CleanGredients:
helps formulators to identify better ingredients
helps suppliers to showcase better ingredients
read more
News and Announcements
Changes to the DfE Safer Product Labeling Standard and the List of Safer Chemicals Ingredients. Through its DfE program, EPA has posted a List of Safer Chemical Ingredients for use in DfE-labeled products. Read more about the list and accompanying changes to the DfE Standard (PDF).http://www.epa.gov/dfe/index.htm Please send questions to Bridget Williams (Williams.Bridget@epa.gov)
Got a question about CleanGredients? You can find answers to many common questions on the CleanGredients FAQ page.
read more
join the mailing list
Search
formulators: find better ingredients
List
suppliers: showcase your ingredients
Subscribe
subscription information
Sponsored by:
ISSA
DeForest
click to sponsor
click to sponsor
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FAQ | Contact Us | Site Map | Policy and Guidelines
EPA
United States Environmental Protection Agency

Sub Topic

External Tools for Assessing Hazards and Finding Alternatives
25 minutes
(Elapsed Time: 1 hour)

Specific Outcomes

Increased use of resources to identify safer chemical alternatives, thereby reducing hazardous substance usage.

Notes for the Facilitator

Say: CleanGredients is an online database containing safer chemical ingredients that are found in cleaning products. This database provides verified information about the environmental and human health attributes of listed ingredients.

CleanGredients is a useful tool for formulators who want to identify safer cleaning ingredients. Formulators who subscribe to the CleanGredients database can find a list of surfactants, solvents, chelating and sequestering agents, and fragrances that meet DfE's Criteria. Nearly 200 formulators are finding safer ingredients on CleanGredients.

CleanGredients streamlines partnership with the U.S. EPA DfE Safer Products Labeling Program by listing ingredient chemicals that are “pre-screened” against the high bar of the DfE’s human and environmental health criteria.

Company ABC was successful in using CleanGredients when replacing X chemical for Y chemical. Doing so resulted in….

Online Resource: For more information visit http://www.cleangredients.org/home

P2: On the Path to Greener Chemistry

Sub Topic

External Tools for Assessing Hazards and Finding Alternatives
25 minutes
(Elapsed Time: 1 hour)

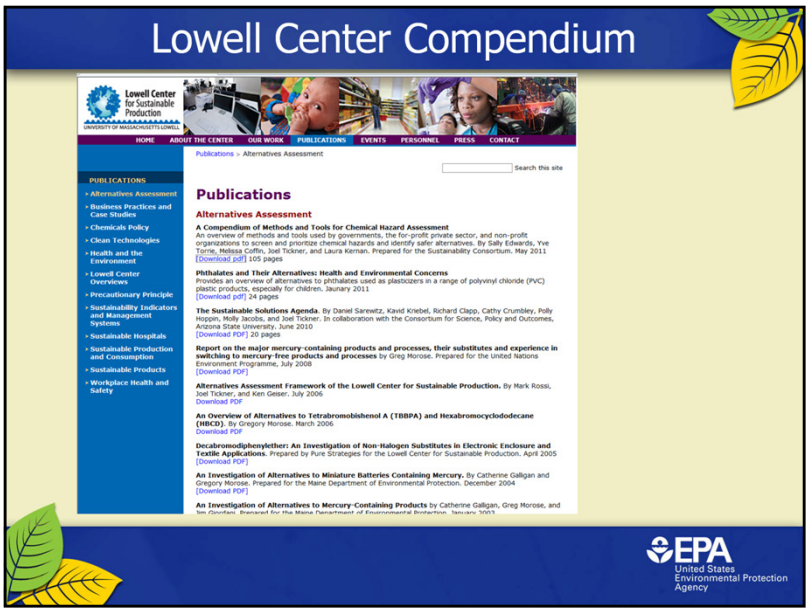
Specific Outcomes

Increased use of resources to identify safer chemical alternatives, thereby reducing hazardous substance usage.

Notes for the Facilitator

Say: This slide provides a screen shot of search results using CleanGredients.

P2: On the Path to Greener Chemistry


Lowell Center Compendium
Lowell Center for Sustainable Production
HOME
ABOUT THE CENTER
OUR WORK
PUBLICATIONS
EVENTS
PERSONNEL
PRESS
CONTACT
Publications > Alternatives Assessment
Search this site
PUBLICATIONS
Alternatives Assessment
Business Practices and Case Studies
Chemicals Policy
Clean Technologies
Health and the Environment
Lowell Center Overviews
Precautionary Principle
Sustainability Indicators and Management Systems
Sustainable Hospitals
Sustainable Production and Consumption
Sustainable Products
Workplace Health and Safety
Publications
Alternatives Assessment
A Compendium of Methods and Tools for Chemical Hazard Assessment
Phthalates and Their Alternatives: Health and Environmental Concerns
The Sustainable Solutions Agenda.
Report on the major mercury-containing products and processes, their substitutes and experience in switching to mercury-free products and processes by Greg Morose. Prepared for the United Nations Environment Programme, July 2008
Alternatives Assessment Framework of the Lowell Center for Sustainable Production.
An Overview of Alternatives to Tetrabromobisphenol A (TBBPA) and Hexabromocyclododecane (HBCD).
Decabromodiphenylether: An Investigation of Non-Halogen Substitutes in Electronic Enclosure and Textile Applications.
An Investigation of Alternatives to Miniature Batteries Containing Mercury.
An Investigation of Alternatives to Mercury-Containing Products
EPA
United States Environmental Protection Agency

Sub Topic

External Tools for Assessing Hazards and Finding Alternatives
25 minutes
(Elapsed Time: 1 hour)

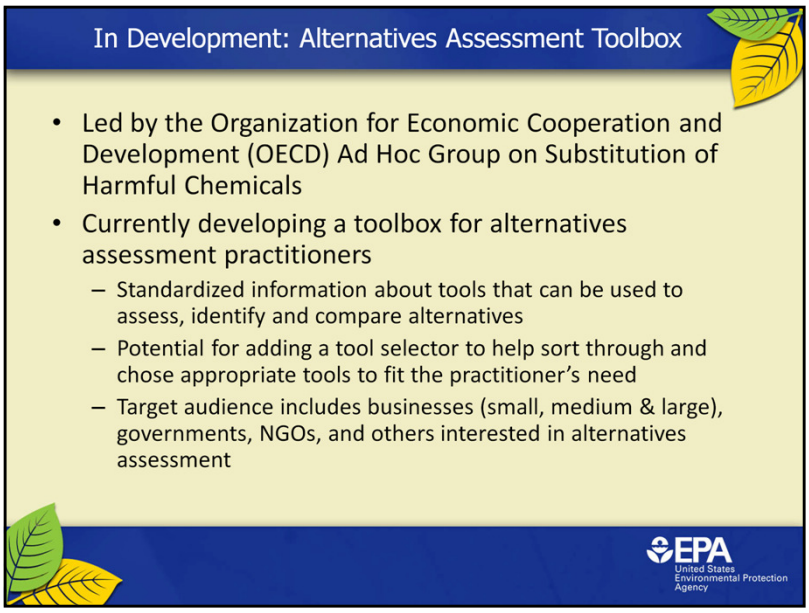
Specific Outcomes

Increased use of resources to identify safer chemical alternatives, thereby reducing hazardous substance usage.

Notes for the Facilitator

Say: The Lowell Center in Massachusetts developed a compendium of methods and tools for hazardous assessments. This compendium provides a description of methods and tools for chemical assessments. The compendium identifies those tools used to screen hazardous chemicals, those that compare alternatives, and those that identify preferred chemicals and products. It provides user-friendly descriptions of each tool, including its ease of use, if there is a cost to use the tool, and the strengths and limitations of each tool.

The Lowell Center Compendium was recently used by Organization A when searching for an appropriate chemical tool to address Y. After identifying the right tool in the Compendium, Organization A was able to XYZ reduce a chemical, or save money, or identify a safer product, etc


In Development: Alternatives Assessment Toolbox
• Led by the Organization for Economic Cooperation and Development (OECD) Ad Hoc Group on Substitution of Harmful Chemicals
• Currently developing a toolbox for alternatives assessment practitioners
– Standardized information about tools that can be used to assess, identify and compare alternatives
– Potential for adding a tool selector to help sort through and chose appropriate tools to fit the practitioner's need
– Target audience includes businesses (small, medium & large), governments, NGOs, and others interested in alternatives assessment
EPA
United States Environmental Protection Agency

Sub Topic

External Tools for Assessing Hazards and Finding Alternatives
25 minutes
(Elapsed Time: 1 hour)

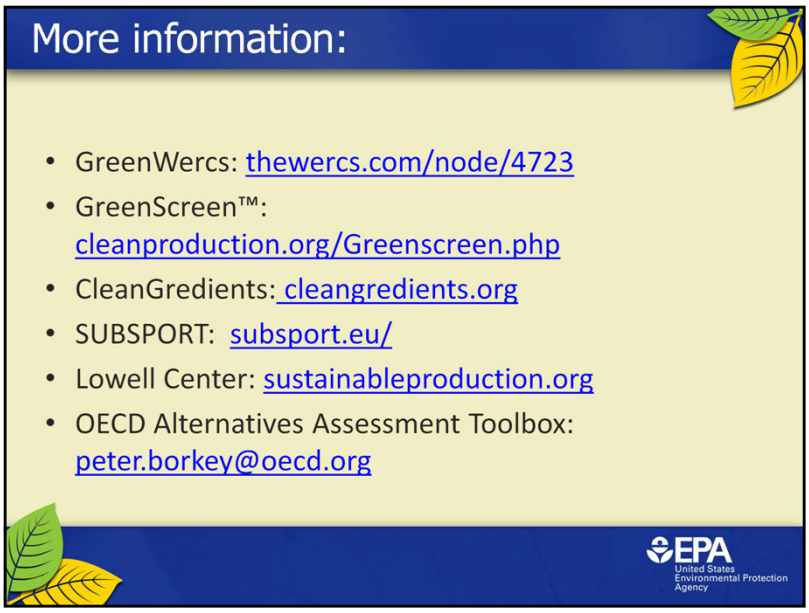
Specific Outcomes

Increased use of resources to identify safer chemical alternatives, thereby reducing hazardous substance usage.

Notes for the Facilitator

Background Information: The OECD, an international governmental body, has convened an ad hoc group to develop a toolbox for alternatives assessment practitioners. This work is in its early stages, supported by a broad group of stakeholders from across the OECD countries, including the US (and its states), Canada, the European Union and New Zealand. Jonathan Rivin, from the University of Wisconsin-Stevens Point, is leading a sub-group to develop an inventory of tools for alternatives assessment as part of this toolbox.

P2: On the Path to Greener Chemistry



Sub Topic

External Tools for Assessing Hazards and Finding Alternatives
25 minutes
(Elapsed Time: 1 hour)

Specific Outcomes

Increased use of resources to identify safer chemical alternatives, thereby reducing hazardous substance usage.

Notes for the Facilitator

Say: This slide provides links to the resources we have discussed to this point of the module.